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ABSTRACT

Chemistry 30 is a twelfth-grade chemistry course for students in Alberta, Canada. This document is a final test for the course. Intended for administration during January, 1986, it contains 56 multiple-choice questions and three written-response questions. Two-and-one-half hours are allowed for completing the test. No answer key is included since scoring is done by the provincial education department. (ML)

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ED274547

GRADE 12 DIPLOMA EXAMINATION

Chemistry 30

January 1986

Alberta
EDUCATION

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GRADE 12 DIPLOMA EXAMINATION
CHEMISTRY 30

DESCRIPTION

TIME: 2½ hours

Total possible marks: 70

This is a **CLOSED-BOOK** examination consisting of two parts:

PART A: 56 multiple-choice questions each with a value of 1 mark.

PART B: Three written-response questions for a total of 14 marks.

A chemistry data booklet is provided for your reference. Approved calculators may be used.

GENERAL INSTRUCTIONS

Fill in the information on the answer sheet as directed by the examiner.

For multiple-choice questions, read each carefully and decide which of the choices BEST completes the statement or answers the question. Locate that question number on the answer sheet and fill in the space that corresponds to your choice. USE AN HB PENCIL ONLY.

Example

This examination is for the subject area of

A. Chemistry
B. Biology
C. Physics
D. Mathematics

Answer Sheet

A	B	C	D
●	②	③	④

If you wish to change an answer, please erase your first mark completely.

For written-response questions, read each carefully, show all your calculations, and write your answer in the space provided in the examination booklet.

NOTE: The perforated pages at the back of this booklet may be torn out and used for your rough work.

DO NOT FOLD EITHER THE ANSWER SHEET OR THE EXAMINATION BOOKLET

The presiding examiner will collect the answer sheet and examination booklet for transmission to Alberta Education.

JANUARY 1986

PART A

INSTRUCTIONS

There are 56 multiple-choice questions with a value of one mark each in this section of the examination. Use the separate answer sheet provided and follow the specific instructions given.

NOTE: The perforated pages at the back of this booklet may be torn out and used for your rough work.

WHEN YOU HAVE COMPLETED PART A, PROCEED DIRECTLY TO PART B

DO NOT TURN THE PAGE TO START THE EXAMINATION UNTIL TOLD TO DO SO BY THE PRESIDING EXAMINER.

1. When $H_2O_{(s)}$ at $-10°C$ is heated to $H_2O_{(l)}$ at $0°C$, there is

   A. an increase in both potential energy and kinetic energy
   B. an increase in kinetic energy and no change in potential energy
   C. an increase in potential energy and a decrease in kinetic energy
   D. a decrease in potential energy and an increase in kinetic energy

2. The total energy of a substance is equal to

   A. $mc\Delta t$
   B. its heat of formation
   C. the sum of its kinetic and potential energies
   D. the difference between its kinetic and potential energies

3. The Law of Conservation of Energy states that

   A. spontaneous processes move toward a state of lower energy
   B. the total amount of energy in the universe remains constant
   C. the energy change for a chemical reaction is independent of the pathway
   D. heat energy always flows from a region of high temperature to one of low temperature

4. The heat of reaction for $Ca_{(s)} + \frac{1}{2}O_{2(g)} \longrightarrow CaO_{(s)}$ is

   A. -63.6 kJ
   B. -227 kJ
   C. -318 kJ
   D. -636 kJ

5. The most stable of the following compounds is

   A. $HF_{(g)}$
   B. $HI_{(g)}$
   C. $HBr_{(g)}$
   D. $HCl_{(g)}$

Use the following information to answer question 6.

I $2NaHCO_{3(s)} + 129.7\ kJ \longrightarrow Na_2CO_{3(s)} + CO_{2(g)} + H_2O_{(g)}$

II $2H_2O_{(l)} + O_{2(g)} \longrightarrow 2H_2O_{2(l)} \qquad \Delta H = +196.3\ kJ$

III $SiH_{4(g)} + 2O_{2(g)} \longrightarrow SiO_{2(s)} + 2H_2O_{(l)} \qquad \Delta H = -1517.5\ kJ$

IV $PbO_{(s)} + CO_{(g)} \longrightarrow Pb_{(s)} + CO_{2(g)} + 65.7\ kJ$

6. Which systems are endothermic?

A. I and II
B. I and III
C. II and IV
D. III and IV

Use the following information to answer question 7.

Carbon monoxide, a dangerous air pollutant, can be formed by the incomplete combustion of carbon, as represented by the equation: $2C_{(s)} + O_{2(g)} \longrightarrow 2CO_{(g)}$

7. The energy term for the balanced equation is conventionally written as

A. 110.5 kJ on the left side of the equation
B. 221.0 kJ on the left side of the equation
C. 110.5 kJ on the right side of the equation
D. 221.0 kJ on the right side of the equation

---

8. The equation which represents an endothermic process is

A. $CH_{4(g)} + 2O_{2(g)} \longrightarrow CO_{2(g)} + 2H_2O_{(g)}$

B. $2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(l)}$

C. $C_4H_{10(l)} \longrightarrow C_4H_{10(g)}$

D. $Pb_{(l)} \longrightarrow Pb_{(s)}$

9. The reaction that would provide the greatest amount of heat is the

A. fission of $^{235}_{92}U$
B. combustion of $CH_{4(g)}$
C. sublimation of $CO_{2(s)}$
D. condensation of $H_2O_{(g)}$

Use the following information to answer question 10.

$H_2O(?) + SO_{3(g)} \longrightarrow H_2SO_{4(l)} \qquad \Delta H = -174$ kJ

The physical state of the water is not known.

10. The molar heat of formation for the water is

A. −40.8 kJ
B. −242 kJ
C. −286 kJ
D. −416 kJ

---

11. The heat of reaction for $2H_2S_{(g)} + 3O_{2(g)} \longrightarrow 2H_2O_{(l)} + 2SO_{2(g)}$ is

A. −562.7 kJ
B. −602.9 kJ
C. −1125.4 kJ
D. −1205.8 kJ

12. The heat of reaction for the equation $2NO_{(g)} + O_{2(g)} \longrightarrow 2NO_{2(g)}$ is

A. −113.2 kJ
B. −56.6 kJ
C. +56.6 kJ
D. +113.2 kJ

13. To raise the temperature of a calorimeter and its contents 1°C requires 5028 J. When 0.5 mol of fuel is burned in the calorimeter the temperature increases 4°C. Using these data, the heat of combustion for the fuel is

A. −100 kJ/mol
B. −60 kJ/mol
C. −40 kJ/mol
D. −20 kJ/mol

14. A bunsen burner that uses methane provides 500 kJ of energy for each mole of fuel burned. The number of moles of methane needed to heat 200 mL of water from 25°C to 50°C is

A. 0.042
B. 5.0
C. 21
D. 24

Use the following information to answer question 15.

$$X + 2T_2 \longrightarrow XT_4 + 83.8 \text{ kJ}$$

$$X + 3T_2 \longrightarrow XT_6 + 209.5 \text{ kJ}$$

15. The predicted ΔH value for $XT_4 + T_2 \longrightarrow XT_6$ is

A. +293.3 kJ
B. +125.7 kJ
C. −125.7 kJ
D. −293.3 kJ

Use the following information to answer question 16.

$$Ag_2O_{(s)} + 2HCl_{(g)} \longrightarrow 2AgCl_{(s)} + H_2O_{(l)} \qquad \Delta H = -324.7 \text{ kJ}$$

$$Ag_{(s)} + \tfrac{1}{2}Cl_{2(g)} \longrightarrow AgCl_{(s)} \qquad \Delta H = -127.0 \text{ kJ}$$

$$\tfrac{1}{2}H_{2(g)} + \tfrac{1}{2}Cl_{2(g)} \longrightarrow HCl_{(g)} \qquad \Delta H = -92.3 \text{ kJ}$$

$$H_{2(g)} + \tfrac{1}{2}O_{2(g)} \longrightarrow H_2O_{(l)} \qquad \Delta H = -285.9 \text{ kJ}$$

16. The heat of formation of silver oxide, $Ag_2O_{(s)}$, is

A. −829.8 kJ/mol
B. −30.6 kJ/mol
C. +4.1 kJ/mol
D. +30.6 kJ/mol

---

17. The calculated amount of energy required to consume 88.0 g of $CO_{2(g)}$ according to the equation $6CO_{2(g)} + 6H_2O_{(l)} + 2824\ kJ \longrightarrow C_6H_{12}O_{6(s)} + 6O_{2(g)}$ is

A. 471 kJ
B. 941 kJ
C. 1410 kJ
D. 3440 kJ

18. The amount of heat released from the combustion of six moles of methane, assuming that water vapor forms, is

A. 448.8 kJ
B. 802.3 kJ
C. 4813.8 kJ
D. 5711.5 kJ

19. During an experiment to classify substances as acids or bases, it is most important to determine the

A. pH of the solution
B. conductivity of the solution
C. concentration of the solution
D. percent dissociation of the solute

Use the following information to answer question 20.

A student wishes to identify a substance as acidic, basic, or neutral by using one or more of the following laboratory tests.

I conductivity of an aqueous solution of the substance
II reaction of the substance with metals below $2H^+/H_2$ in a standard reduction potential table
III reaction of the substance with red and blue litmus
IV color of an aqueous solution of the substance

20. As a minimum, the student needs to perform

A. III only
B. I and III only
C. III and IV only
D. I, II, and III only

21. The equation that represents a neutralization reaction is

A. $Zn_{(s)} + 2H^+_{(aq)} + 2Cl^-_{(aq)} \longrightarrow H_{2(g)} + Zn^{2+}_{(aq)} + 2Cl^-_{(aq)}$

B. $NaOH_{(s)} + H^+_{(aq)} + Cl^-_{(aq)} \longrightarrow Na^+_{(aq)} + H_2O_{(l)} + Cl^-_{(aq)}$

C. $4NO^-_{3(aq)} + 4H^+_{(aq)} \longrightarrow 4NO_{(g)} + 2H_2O_{(l)} + 3O_{2(g)}$

D. $2CH_3OH_{(l)} + 3O_{2(g)} \longrightarrow 2CO_{2(g)} + 4H_2O_{(l)}$

22. After adding sodium hydrogen sulphate to distilled water, a student should predict that

A. the pH would increase
B. the $[H_3O^+_{(aq)}]$ would increase
C. a basic solution would result
D. a neutral solution would result

23. Consider the equation $H_2CO_{3(aq)} + HPO^{2-}_{4(aq)} \leftrightharpoons HCO^-_{3(aq)} + H_2PO^-_{4(aq)}$. Which of the following pairs identifies the two acids for this reaction?

A. $HPO^{2-}_{4(aq)}$ and $HCO^-_{3(aq)}$

B. $H_2CO_{3(aq)}$ and $HCO^-_{3(aq)}$

C. $H_2CO_{3(aq)}$ and $H_2PO^-_{4(aq)}$

D. $HPO^{2-}_{4(aq)}$ and $H_2PO^-_{4(aq)}$

24. Since $HNO_{3(aq)}$ is a stronger acid than $HNO_{2(aq)}$, the

A. H^+ is more strongly bonded to NO^-_3 than to NO^-_2
B. $NO^-_{2(aq)}$ ion is a stronger base than the $NO^-_{3(aq)}$ ion
C. $NO^-_{3(aq)}$ ion is a better proton acceptor than the $NO^-_{2(aq)}$ ion
D. $HNO_{2(aq)}$ molecule is a better proton donor than the $HNO_{3(aq)}$ molecule

25. For the reaction represented by $PO^{3-}_{4(aq)} + HCO^-_{3(aq)} \leftrightharpoons HPO^{2-}_{4(aq)} + CO^{2-}_{3(aq)}$, the strongest base is

A. $HPO^{2-}_{4(aq)}$

B. $HCO^-_{3(aq)}$

C. $PO^{3-}_{4(aq)}$

D. $CO^{2-}_{3(aq)}$

26. The pH of a solution is defined as the

A. log of the concentration of hydronium ions
B. negative log of the concentration of hydronium ions
C. log of the negative concentration of hydronium ions
D. negative log of the inverse concentration of hydronium ions

27. The pH of a 0.10 mol/L solution of oxalic acid is equal to

A. 1.00
B. 1.28
C. 2.72
D. 5.30

Use the following information to answer question 28.

The addition of various indicators to a nitric acid solution produces the following results:

Test Tube	Indicator Added	Color of Solution
1	orange IV	yellow
2	methyl orange	yellow
3	bromocresol green	blue
4	methyl red	orange
5	bromothymol blue	yellow

28. The most probable concentration for the solution is

A. 4.0×10^{-3} mol/L
B. 8.0×10^{-5} mol/L
C. 2.5×10^{-6} mol/L
D. 3.2×10^{-7} mol/L

---

29. The equation which represents the dissociation of $HS^-_{(aq)}$ is

A. $HS^-_{(aq)} + H_2O_{(l)} \rightleftharpoons H_2S_{(aq)} + OH^-_{(aq)}$

B. $HS^-_{(aq)} + H_3O^+_{(aq)} \rightleftharpoons H_2S_{(aq)} + H_2O_{(l)}$

C. $HS^-_{(aq)} + H_2O_{(l)} \rightleftharpoons S^{2-}_{(aq)} + H_3O^+_{(aq)}$

D. $HS^-_{(aq)} + H_2O_{(l)} \rightleftharpoons H_{2(g)} + S^{2-}_{(aq)} + OH^-_{(aq)}$

30. The $[H_3O^+_{(aq)}]$ of 0.10 mol/L lactic acid, $CH_3CHOHCOOH_{(aq)}$, is 4.0×10^{-3} mol/L. The per cent of the acid that is dissociated is

A. 4.0
B. 0.25
C. 0.080
D. 0.040

31. A property common to acidic and basic solutions is that they both

A. have a bitter taste
B. have a K_w of 1×10^{-14} mol^2/L^2
C. react with calcium metal to form $H_{2(g)}$
D. have hydroxide ion concentrations of 1×10^{-7} mol/L

32. The $[H_3O^+_{(aq)}]$ in 2 L of solution prepared by dissolving 1.12 g of $KOH_{(s)}$ in distilled water is

A. 1×10^{-1} mol/L
B. 1×10^{-2} mol/L
C. 1×10^{-12} mol/L
D. 1×10^{-13} mol/L

33. Given 0.10 mol/L solutions of $HOCl_{(aq)}$, $HF_{(aq)}$, $HCN_{(aq)}$, and $CH_3COOH_{(aq)}$, the solution with the largest $[OH^-_{(aq)}]$ is

A. $HF_{(aq)}$
B. $HCN_{(aq)}$
C. $HOCl_{(aq)}$
D. $CH_3COOH_{(aq)}$

Use the following information to answer question 34.

A student dissolved 36.0 g of $NaHSO_{4(s)}$ in enough $H_2O_{(l)}$ to make 500.0 mL of solution and then titrated 50.0 mL of this solution with 2.00 mol/L $KOH_{(aq)}$.

34. The volume of $KOH_{(aq)}$ needed to neutralize 50.0 mL of $NaHSO_{4(aq)}$ is

A. 45.0 mL
B. 30.0 mL
C. 15.0 mL
D. 7.50 mL

Use the following information to answer question 35.

An unknown solution conducts electricity. As the solution is titrated with $Ba(OH)_{2(aq)}$, the resulting mixture turns cloudy and its conductivity decreases.

35. The unknown solution could be

A. $H_2SO_{4(aq)}$
B. $NaOH_{(aq)}$
C. $HCl_{(aq)}$
D. $HBr_{(aq)}$

---

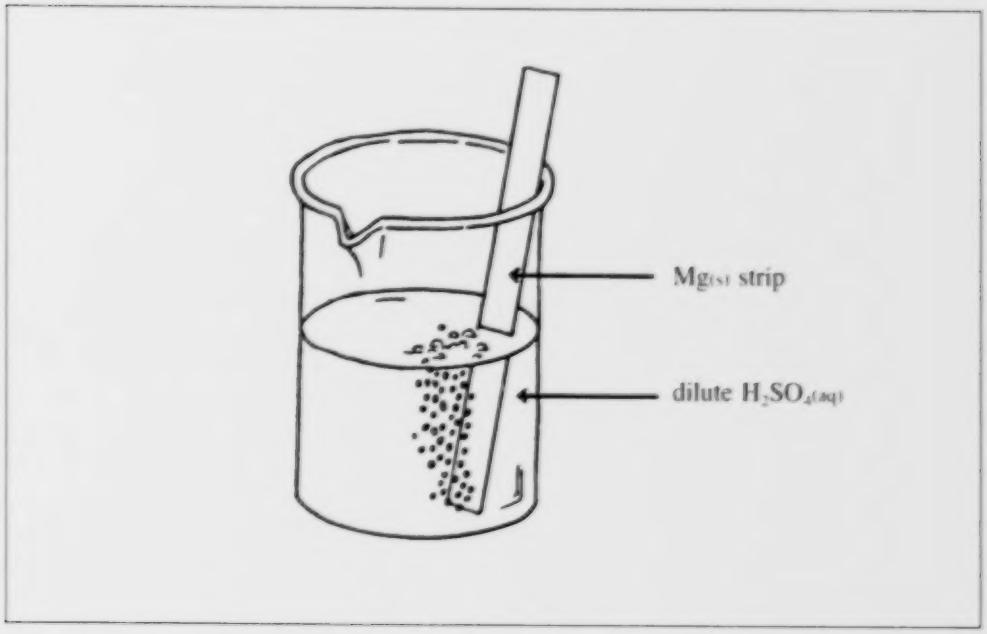
36. A solution is prepared by adding 4.99 L of 2.00 mol/L $HCl_{(aq)}$ to 5.00 L of 2.00 mol/L $NaOH_{(aq)}$. The $H_3O^+_{(aq)}$ concentration of the mixture will be

A. 5.0×10^{-12} mol/L
B. 2.0×10^{-4} mol/L
C. 2.0×10^{-2} mol/L
D. 1.0×10^{-1} mol/L

37. If 50.0 mL of 0.40 mol/L $HCl_{(aq)}$ were added to 100.0 mL of 0.20 mol/L $LiOH_{(aq)}$, the final solution would

A. be neutral
B. have a sour taste
C. have a bitter taste
D. change colorless phenolphthalein to pink

Use the following information to answer question 38.



38. The best conclusion is that the $Mg_{(s)}$ strip

A. loses mass
B. gains mass
C. undergoes reduction
D. produces magnesium sulphide

---

39. An example of reduction is

A. $I \longrightarrow I^-$
B. $I^- \longrightarrow I$
C. $Fe \longrightarrow Fe^{2+}$
D. $Fe^{2+} \longrightarrow Fe^{3+}$

40. $Cu_{(s)}$ is placed in 1.0 mol/L $AgNO_{3(aq)}$. The oxidizing agent is

A. $Ag_{(s)}$
B. $Cu_{(s)}$
C. $Ag^{+}_{(aq)}$
D. $Cu^{2+}_{(aq)}$

41. The net equation representing the reaction between chlorine gas and aqueous sodium iodide is

A. $2Cl^{-}_{(aq)} + I_{2(s)} \longrightarrow Cl_{2(g)} + 2I^{-}_{(s)}$

B. $Na^{+}_{(aq)} + Cl_{2(g)} \longrightarrow Na_{(s)} + 2Cl^{-}_{(aq)}$

C. $Cl_{2(g)} + 2I^{-}_{(aq)} \longrightarrow 2Cl^{-}_{(aq)} + I_{2(s)}$

D. $Na^{+}_{(aq)} + I_{2(s)} + 2Cl^{-}_{(aq)} \longrightarrow Na_{(s)} + 2I^{-}_{(aq)} + Cl_{2(g)}$

42. In which species does S have the lowest oxidation number?

A. $H_2S_2O_7$

B. $S_2O_3^{2-}$

C. $S_4O_6^{2-}$

D. $KHSO_3$

43. An increase in oxidation number indicates a species

A. is reduced
B. gains electrons
C. loses electrons
D. is an oxidizing agent

44. For this equation, $MnO^{-}_{4(aq)} + C_2O_4^{2-}{}_{(aq)} + H^{+}_{(aq)} \longrightarrow Mn^{2+}_{(aq)} + H_2O_{(l)} + CO_{2(g)}$, the oxidizing agent and reducing agent, respectively, are

A. $H^{+}_{(aq)}$ and $H_2O_{(l)}$
B. $Mn^{2+}_{(aq)}$ and $CO_{2(g)}$
C. $MnO^{-}_{4(aq)}$ and $Mn^{2+}_{(aq)}$
D. $MnO^{-}_{4(aq)}$ and $C_2O_4^{2-}{}_{(aq)}$

45. For a balanced redox equation, the substances oxidized and reduced must exchange

A. equal numbers of electrons
B. equal numbers of electrons per atom
C. equal numbers of electrons per formula unit
D. enough electrons so that their oxidation numbers become equal

Use the following information to answer question 46.

$$MnO_4^-(aq) + SO_2(g) + H_2O(l) \longrightarrow Mn^{2+}(aq) + SO_4^{2-}(aq) + H^+(aq)$$

is an unbalanced equation.

46. When the equation is balanced with whole numbers, the sum of the coefficients is

A. 10
B. 16
C. 18
D. 20

---

47. 20.0 mL of acidified $MnO_4^-(aq)$ is titrated to its endpoint with 40.0 mL of 0.200 mol/L $Sn^{2+}(aq)$. The molar concentration of the $MnO_4^-(aq)$ is

A. 0.160 mol/L
B. 0.400 mol/L
C. 0.640 mol/L
D. 1.00 mol/L

48. $AlCl_3(l)$ undergoes electrolysis in an electrolytic cell and 5.40 g of $Al(l)$ are collected at the cathode. The mass of $Cl_2(g)$ collected at the anode is

A. 7.10 g
B. 14.2 g
C. 21.3 g
D. 42.6 g

17

Use the following information to answer question 49.

As part of a laboratory procedure a student recorded observations after placing strips of metal into aqueous solutions according to the following combinations.

Metals \ Ions	$Be^{2+}_{(aq)}$	$Cd^{2+}_{(aq)}$	$Ra^{2+}_{(aq)}$	$V^{2+}_{(aq)}$
$Be_{(s)}$		reaction	no change	reaction
$Cd_{(s)}$	no change		no change	no change
$Ra_{(s)}$	reaction	reaction		reaction
$V_{(s)}$	no change	reaction	no change	

49. The grouping in which the oxidizing agents are arranged from strongest to weakest is

A. $Cd_{(s)}$, $V_{(s)}$, $Be_{(s)}$, $Ra_{(s)}$
B. $Ra_{(s)}$, $Be_{(s)}$, $V_{(s)}$, $Cd_{(s)}$
C. $Ra^{2+}_{(aq)}$, $Be^{2+}_{(aq)}$, $V^{2+}_{(aq)}$, $Cd^{2+}_{(aq)}$
D. $Cd^{2+}_{(aq)}$, $V^{2+}_{(aq)}$, $Be^{2+}_{(aq)}$, $Ra^{2+}_{(aq)}$

---

50. Negative E° values for reduction half-reactions indicate

A. less tendency than the reference half-reaction to undergo reduction
B. that these reducing agents lose electrons less readily than does $H_{2(g)}$
C. greater tendency than the reference half-reaction to undergo reduction
D. that these oxidizing agents gain electrons more readily than does $H^+_{(aq)}$

51. When solid copper is immersed in a solution of silver nitrate all of the following occur EXCEPT

A. the solution turns blue
B. silver metal is produced
C. the mass of Cu increases
D. the concentration of silver ions decreases

Use the following information to answer question 52.

The reaction $2X^- + R \longrightarrow R^{2-} + 2X$ takes place spontaneously generating a voltage of 1.20 V.

52. If the E° value for the half-reaction $2X^- \longrightarrow 2X + 2e^-$ is -0.80 V, the potential for the half-equation $R + 2e^- \longrightarrow R^{2-}$ would be

A. +2.00 V
B. +0.40 V
C. +0.20 V
D. −0.40 V

---

53. The species that react spontaneously are

A. $Cr^{3+}(aq)$, $H_2O(l)$, $Co^{2+}(aq)$

B. $H_2SO_3(aq)$, $H_2O(l)$, $Cl_2(g)$

C. $I_2(s)$, $H^+(aq)$, $NO_3^-(aq)$

D. $I_2(s)$, $Br^-(aq)$

Use the following information to answer question 54.

Two electrolytic cells are set up in a circuit so that they receive the same current for the same length of time. One half-reaction for each of the two cells is:

Cell 1: $Al^{3+}(l) + 3e^- \longrightarrow Al(l)$

Cell 2: $Na^+(l) + e^- \longrightarrow Na(l)$

54. If 1.38 g of sodium are produced, how many moles of aluminum are produced?

A. 0.0200 mol
B. 0.0300 mol
C. 0.0500 mol
D. 0.0600 mol

Use the following information to answer question 55.

Given the statements:

I Anions migrate to the anode and cations migrate to the cathode.

II Electrons flow from the anode to the cathode.

III Oxidation occurs at the anode and reduction occurs at the cathode.

55. Both electrochemical and electrolytic cells are described by

A. I only
B. II only
C. I and II only
D. I, II, and III

---

56. When the surface of a tin can is scratched, the exposed iron rusts rapidly. One explanation is that an electrochemical process occurs in which

A. tin is the anode
B. iron is the anode
C. tin is the cathode
D. iron is the cathode

YOU HAVE NOW COMPLETED THE MULTIPLE-CHOICE SECTION OF THE EXAMINATION. PLEASE PROCEED TO THE NEXT PAGE AND ANSWER THE WRITTEN-RESPONSE QUESTIONS IN PART B.

PART B

INSTRUCTIONS

Please write your answers in the examination booklet as neatly as possible.

Marks will be awarded for pertinent explanations, calculations, formulas, and answers. Answers must be given to the appropriate number of significant digits.

NOTE: The perforated pages at the back of this booklet may be torn out and used for your rough work.

TOTAL MARKS: 14

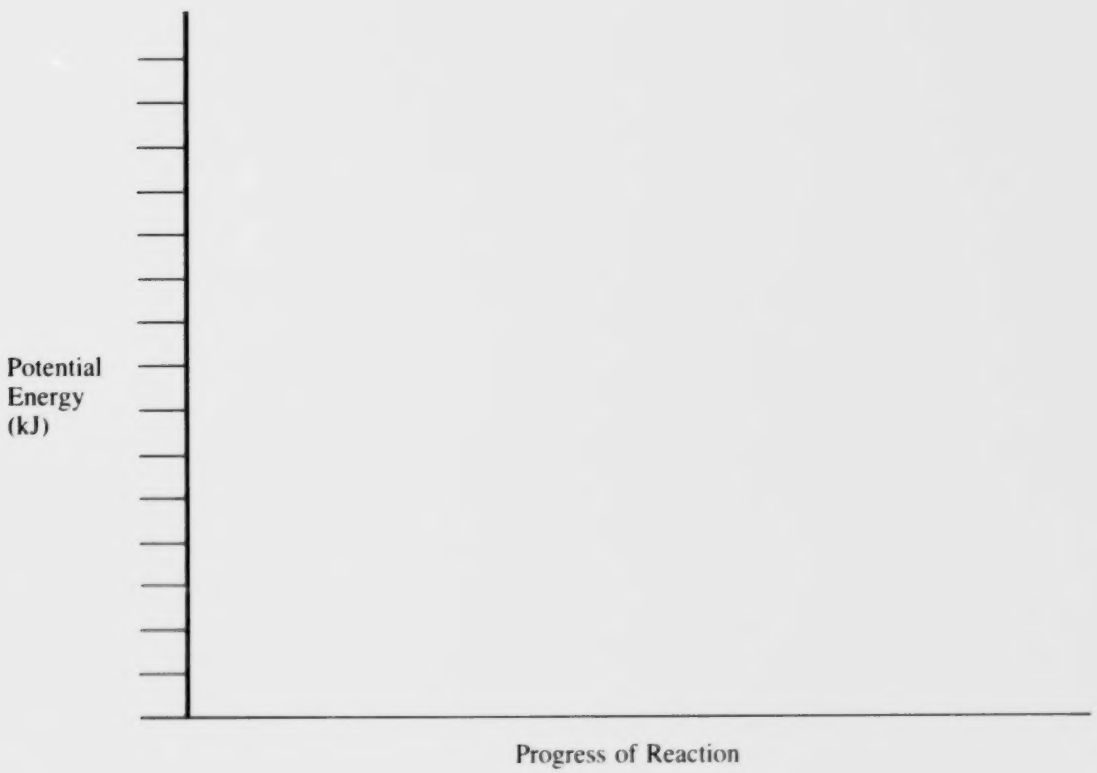
START PART B IMMEDIATELY

(5 marks) 1. Aluminum reacts with iron (III) oxide to form iron metal and aluminum oxide. Place numerical values on the axis provided and draw a labelled potential energy diagram for this reaction. Write a balanced equation and show your calculations in the space provided.

Balanced equation:

Calculations:

Diagram:



Use the following information to answer question 2.

Three hypothetical acids HX, HY, and HZ and their conjugate bases X^-, Y^-, and Z^- gave the following information when tested for reaction.

$HX + Y^- \rightleftharpoons HY + X^-$ (equilibrium concentrations favor products)

$HX + Z^- \rightleftharpoons HZ + X^-$ (equilibrium concentrations favor reactants)

(4 marks) 2. a. List the acids with their conjugate bases from strongest acid to weakest.

strongest acid 1. _____ its conjugate base _____

2. _____ its conjugate base _____

3. _____ its conjugate base _____

b. Which ion would form the weakest bond with hydrogen ions?

c. Write a Brønsted-Lowry equation for the reaction of HY with Z^- and predict which side is favored at equilibrium.

equation:

_____

equilibrium concentrations favor _____

Use the following information to answer question 3.

Scientists isolated a previously undiscovered metal of which they managed to produce a few thin strips. They predicted that the metal would fit between tin and lead on the Table of Standard Electrode Potentials. Assume they give you the metal strips and you have access to a lab with various common metals and solutions of their ions. Use the symbol $M_{(s)}$ to represent the new metal.

(5 marks) 3. **a.** List 2 steps you could use as an experimental procedure that would test the scientists' prediction.

Step 1. _____

_____

Step 2. _____

_____

b. Assume that the scientists' prediction was verified and state the observations that you would expect for each step.

Step 1. _____

Step 2. _____

c. Assume the scientists' prediction was verified and write a possible balanced equation for each reaction that occurred involving the unknown metal.

d. Give a probable E° value for the reduction half-reaction of the metal.

YOU HAVE NOW COMPLETED THE EXAMINATION. IF YOU HAVE TIME, YOU MAY WISH TO GO BACK AND CHECK YOUR ANSWERS.

TEAR-OUT SHEET

(NO MARKS WILL BE GIVEN FOR WORK DONE ON THIS PAGE)

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CHEMISTRY 30

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